

**Morocco WPM Watershed Protection and Management
Task Order No. 814 under the BIOFOR IQC**
Contract No. LAG-I-00-99-00014-00

Construction of Water Reservoirs

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CHEMONICS

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Introduction

Under the Morocco Water Resources Sustainability project (WRS) funded by the USAID-Morocco, there was construction of water reservoirs as a measure to secure water supply for the newly olive trees planted area during the extend drought period that prevailed in the area at the beginning of the project. This measure was, then, a success since the water stored was not only used for irrigation of the olive trees but also for animals and for some households' activities. The farmers and the population of the areas where the reservoirs were planted have greatly appreciated this action. One reason for that is that after the olive trees will get older, they will become more adapted to the local climate and then will become less relying on irrigation during the summer time. The water saved will be used by farmers to irrigated small vegetables or wheat plots contributing to the improvement of the income of the farmers.

Under the Watershed Protection and Management project (WPM), which was designed to replicate the success of WRS, the construction of more water reservoirs was among the farmers proposed actions to be implemented in the watershed.

Objectives:

The overall objective of the construction of water reservoirs is to collect water that run from sources and springs to be used by the farmers or the population of the area. The specific objectives of collecting water from sources and springs in reservoirs can be listed as follow:

- To provide supplemental irrigation to olive trees planted in the area and to other annual crops grown in a small scale to minimize the risk of crop failure.
- To supply drinking water for animals
- To supply domestic water for people

Methodology:

In this action we used the same methodology as the one used under WRS and WPM projects. We relied, and we will continue to rely, on local administrations (DPA of Tetouan and the CT of Ben Karrich) both in the survey and in the implementation phases. A participatory approach was, then, used regarding the population. The sources of water and the springs that will undergo rehabilitation under this project are chosen and validated in collaboration with the farmers of the area.

We start with a survey in the olive trees planted areas to identify the sources of water and springs that might be of interest to this project. The sources have to be permanent, which means that they must have a continuous flow of water. Since private person owns each source in the private land, we should have the approval from the owner(s) to go ahead with the rehabilitation. Seven approvals are already done and more effort is underway to get approvals for the rest. The approvals must be in writing and should state that the owner is given free access to the water stored in the reservoir for anybody willing to irrigate its trees or crops located close to the sources. In case the reservoir has to be built outside of the source owner property, a writing approval must be done from both the owner of the source and the owner of the land where the reservoir will be constructed.

A survey has been done in the period of June 2-6, 2003. Twenty-eight sources have been identified (Table 1). These sources are scattered between zone II, Zone III and Zone VI of the WPM olive tress planted areas.



Figure1: Example of source of water in natural state.

Implementation:

A private contractor will do the implementation of this action. However, a team consisting from DPA, CT and the WPM project will supervise and assist in the implementation. Frequent visits will be made to the site to supervise the private contractor in his work.

The implementation will consist of three parts:

- a. The rehabilitation of water sources and springs: The sources will undergo minimum disturbance to avoid loosing the underground water pathway. Some of the sources will be totally covered when their use include also the domestic activities.



Figure 2: Example of source rehabilitated under WRS project

- b. The construction of a water canal: The canal will be underground and will take water from the source to the water reservoir. The length of this canal will depend on the location of the source to the land where the reservoir will be constructed.



Figure 3: Example of underground water canal under construction

- c. The construction of the water reservoirs: Each reservoir will have a water storage capacity of about 10 m^3 . The reservoirs will be constructed on private lands after proper approvals have been obtained from the owner(s) of the land.



Figure 4: Example of reservoir constructed under WRS

The cost

Table 2 shows an estimated cost done by the DPA . This cost includes the rehabilitation of one source and the construction of one water canal and reservoir and are in Moroccan Dirhams.

Table 1: water Sources/springs identified and proposed for the rehabilitation

N° par ordre d'importance	Dénomination de la source	Localisation au niveau du bassin versant	Proposition d'aménagement			Observations
			Source à aménager	Longueur de la Canalisation en mètre	Nbre Résevoirs	
1	Tibaranene	Achekrade Z III coté Ouest B.V.N	1	30	2	
2	Toumrite	Bouatou Z II coté Est B.V.N	Aménagée	150	1	Contrat établi
3	Sayed	Zone VI. Kouades coté Ouest B.V.N	1	30	1	
4	Imikane	Zone V Bouatou côté Ouest B.V.N	1	25	1	
5	Ikhouja	Zone III Achekrad côté Est B.V.N	1	30	1	Contrat établi
6	Louli	Zone III Achekrad côté Est B.V.N	1	30	1	Contrat établi
7	Jnan M'hamed Daoud	Zone III ou milieu du B.V.N	1	70	1	
8	Tafifout Foukia	Zone II Azemour côté Ouest B.V	1	25	1	
9	Tifezouene Seflie	Zone Achekrad Kouades côté Ouest B.V.N	1	25	1	
10	Talabarhount	Zone Achekrad côté Ouest B.V.N	1	50	1	
11	Aboukhouch	Zone Achekrad	1	20	1	Contrat établi
12	Amane Amrane	Zone Bouatou	1	20	1	
13	Ain Ahssis	Kouades zone III	1	30	1	
14	Amane Soumane	Zone II Azemour	1	40	1	Contrat établi
15	Talahsnane	Zone II Achekrad	1	40	1	
16	Ain Ababou Foukia	Kouades zone III	1	20	1	
17	Stare	Zone II Azemour	1	20	1	Contrat établi
18	Tifizouene Foukia	Zone III. Kouades coté Ouest B.V.N	1	25	1	
19	Ain Atea	Kouades	1	15	1	
20	Tazroud	Zone III. Achekrad	1	20	1	
21	Aïn Tazroud	Bouatou Zone II coté Ouest B.V.N	1	10	1	
22	Saïk	Zone II Azemour côté Ouest B.V.N	1	15	1	
23	Kharara	Zone III Achekrad B.V.N	1	50	1	
24	Aïn Aheik	Bouatou	1	15	1	
25	Aïn Sikha	Zone III. Kouades	1	40	1	
26	Ababou Seflia	Zone III. Kouades	1	10	1	Contrat établi
27	Mahraz	Zone III. Achekrad	1	15	1	
28	Ain Achir	Kouades zone III	1	50	1	

Table 2: Estimated cost of including the rehabilitation of one water source, the construction of one water canal (length=40m)and one reservoir in Moroccan Dirhams.

N	Désignation des ouvrages	Unités	Quantités	P.unitaires	Totaux
1	Terrassement en masse ou en rigoles ; compris épuisement d'eau et évacuation des déblais	M ³	30,00	30,00	900,00
2	Plus value pour terrassement dans le rocher ; même sujections que le prix n° 1	M ³	3,00	100,00	300,00
3	Béton de propreté dosé à 150 Kg	M ³	1,00	800,00	800,00
4	Maçonnerie de moellons en fondations et élévation	M ³	8,00	400,00	3.200,00
5	Blocage en pierres sèches de 0,20 m	M ²	11,00	45,00	495,00
6	Béton pour béton armé dosé à 350 Kg de ciment CPJ 45 par m ³	M ³	8,5	1.600,00	13.600,00
7	Acier TOR pour armatures	Kg	500,00	12,00	6.000,00
8	Enduits étanches dosés à 500 Kg de ciment ; compris adjuvent	M ²	24,00	50,00	1.200,00
9	Enduits ordinaires	M ²	24,00	30,00	720,00
10	Crépine de 1 ^{er} choix 1''	U	1	500,00	500,00
11	Tampon métallique de 0,60 x 0,50 compris cadre ; peinture ; serrures ; cadenas	U	1	400,00	400,00
12	Tampon métallique de 1x 0,80 même prescription que prix n° 1	U	1	700,00	700,00
13	Tuyau en PVC de 1'' compris raccord ; Tè ; coude et tout accessoires pour mise en service	ML	40	120,00	4.800,00
14	Robinet de rinçage 16/27	U	1	150,00	150,00
15	Tuyau métallique en acier galvanisé 1/4''	ML	3,00	80,00	240,00
16	Tuyau métallique en acier galvanisé 1''	ML	2,00	250,00	500,00
17	Grille métallique	M ²	0,25	300,00	75,00
					34.580,00

Arrêté le présent devis à la somme de: Trente Quatre Mille Cinq Cent Quatre Vingt Dirhams.
(34.580,00 Dh TTC.)

DEVIS (Entrepreneur)

N	Désignation des ouvrages	Unités	Quantités	P.unitaires	Taux
1	Terrassement en masse ou en rigoles ; compris épuisement d'eau et évacuation des déblais	M ³	30.00	50.00	1500.00
2	Plus value pour terrassement dans le rocher ; même sujections que le prix n° 1	M ³	3.00	150.00	450.00
3	Béton de propreté dosé à 150 Kg	M ³	1.00	550.00	550.00
4	Maçonnerie de moellons en fondations et élévation	M ³	8.00	300.00	2400.00
5	Blocage en pierres sèches de 0,20 m	M ²	11.00	60.00	660.00
6	Béton pour béton armé dosé à 350 Kg de ciment CPJ 45 par m ³	M ³	8.5	1800.00	15300.00
7	Acier TOR pour armatures	Kg	500.00	15.00	7500.00
8	Enduits étanches dosés à 500 Kg de ciment ; compris adjuvent	M ²	24.00	70.00	1680.00
9	Enduits ordinaires	M ²	24,00	40.00	960.00
10	Crépine de 1 ^{er} choix 1''	U	1.00	500.00	500.00
11	Tampon métallique de 0,60 x 0,50 compris cadre ; peinture ; serrures ; cadenas	U	1.00	1000.00	1000.00
12	Tampon métallique de 1x 0,80 même prescription que prix n° 1	U	1.00	500.00	500.00
13	Tuyau en PVC de 1'' compris raccord ; Tè ; coude et tout accessoires pour mise en service	ML	40.00	130.00	5200.00
14	Robinet de rinçage 16/27	U	1.00	150.00	150.00
15	Tuyau métallique en acier galvanisé 1/4''	ML	3.00	150.00	360.00
16	Tuyau métallique en acier galvanisé 1''	ML	2.00	200.00	400.00
17	Grille métallique	M ²	0.25	300.00	75.00
					39,185.00

Arrêté le présent devis à la somme de: Trente Neuf Mille Cent Quatre Vingt Cinq dirhams (TTC)